OBSERVATIONS ON SNOW MOSQUITOES IN CALIFORNIA

(Diptera: Culicidae)

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In the course of a general study of Californian mosquitoes a number of collections were made during the spring months of 1947, 1948 and 1949 in the central and northern Sierra. These included many of the so-called "snow *Aedes*", the larvae of which breed in pools resulting more or less directly from melting snow. These species are characteristic of the colder parts of North America including northern United States, and some of them extend their range south at progressively higher altitudes along the mountain ranges.

The snow *Aedes* are mainly in the subgenus *Ochlerotatus* which contains some of the most difficult species of mosquitoes taxonomically speaking. The females are separated largely on the scutal pattern and as this is subject to some variation, no existing key is entirely satisfactory. Differences in the male genitalia are mostly slight, particularly between closely related species. The larvae offer some of the best characters, but these are unfortunately plastic and few published descriptions have given the range of variation. Keys are frequently based on the exact branching of the head hairs or the number and shape of the comb scales which may result in exclusion of 10 to 25 per cent or more of a variable population. Some of these variations are discussed below.

Eight species have been known to occur in California and a ninth is herein added to the list. Also, personal locality and date records are given for the benefit of collectors in the future.

AEDES INCREPITUS Dyar

This species is the most widespread snow mosquito in California. It occurs in various parts of the state from 7,500 feet elevation to practically sea level. At lower elevations its outbreaks are worst following extremely cold winters. The larvae are found

in shade or sun, in meadows or roadside ditches, in pine-needle pools or water in dense willow thickets, in hoofprints or in large ponds. The adults are the chief open sun, day-biting mosquito of the Sierra at elevations of 6,000 to 7,000 feet.

The larvae are similar to those of *communis* except that the upper head hairs (C) are usually double or triple and the lower head hairs (B) are single or double. However, this distinction does not always hold. In 50 specimens selected at random from a collection made from a large willow-shaded pool near Alturas, Modoc Co., 52 of the upper head hair are single, 46 are double, and 2 are triple, giving an average of 1.5 branches. Furthermore, 17 of the 50 specimens have all 4 of the head hairs single. This same tendency toward singleness is present in a collection from a large willow-shaded pool near Susanville, Lassen Co. Here, a check on 21 specimens reveals 10 upper head hairs single, 29 double and 3 triple, giving an average of 1.8 branches. These figures can be compared with a coast range collection made in Sonoma Co. where 14 specimens have 27 upper head hairs double and 1 triple for an average of 2.0 branches. A further comparison can be made with Sierran material in which 18 larvae from several central Sierran localities have 13 upper head hairs double, 21 triple and 2 quadruple for an average of 2.7 branches. Furthermore, of the lower head hairs, which are almost invariably single from other localities, 6 out of 36 in the central Sierran material are double. The Susanville and Alturas specimens are distinguished by having most of the comb scales very broad, whereas only a few of the scales are of this type in the material from the other localities mentioned. The broadened comb scales and frequently single head hairs increase the chance of misidentifying single larvae as *communis*. However, the comb scales of *increpitus*, even when stout, are pointed instead of rounded at the tip as in *communis*.

Personal records of larval collections are as follows: Chimney Rocks near Alturas, Modoc Co., May 24, 1949; Canyon Dam, Plumas Co., April 30, 1947; Susanville, Lassen Co., May 8, 1948; Calpine, Sierra Co., April 29, 1947; Little Truckee River near Lake Tahoe, Eldorado Co., June 1, 1947; Grass Lake (Luther Pass), Eldorado Co., May 21, 1948; Meyers Meadows, Eldorado Co., May 21, 1948; Emigrant Gap, Placer Co., April 29, 1947; 7 miles west of Sonora Pass, Tuolumne Co., April 4, 1949; Cordelia, Solano Co., April 6, 1949.

AEDES FITCHII (Felt and Young)

This is one of the two snow mosquitoes in the state with banded tarsi, the other being *increpitus*. Adults can be distinguished by the more uniform distribution of white scales on the wing of *fitchii*. The species is relatively uncommon but when found, the females bite readily in light shade. The larvae seem to prefer sunlit ponds of moderate size, particularly if they contain tules. Personal collecting records of larvae are from Sierraville, Sierra Co., April 29, 1947; Little Truckee River near Lake Tahoe, June 1, 1947; and near Baxter, Placer Co., April 29, 1947.

AEDES COMMUNIS (DeGeer)

This species is abundant and widespread at elevations of 5,000 to 6,000 feet in the northern Sierra and 6,000 to 8,500 feet at the latitude of Tuolumne Co. The larvae are almost always restricted to shaded pine needle pools. The adults bite in deep shade during the day but are particularly troublesome at dusk. There is frequent association with *hexodontus* and both species in the female have a short pale basal costal spot, all dark palpi, front surface of the mid femur unevenly and not contrastingly speckled, and no hypostigial spot. Females of *communis*, however, usually have the outer surface of the torus yellowish; mixed pale and dark upright vertex scales (in California specimens); the scutum with a median, often split, golden line; and the supra-alar bristles dark.

Personal larval records are: Canyon Dam, Plumas Co., April 30, 1947; Calpine, Sierra Co., April 29, 1947; near Baxter, Placer Co., April 29, 1947; Cisco Grove, Placer Co., April 29, 1947; Camp Sacramento, Eldorado Co., May 17, 1947; Carson Pass, Alpine Co., April 29, 1947; Blue Lakes, Alpine Co., July 12, 1948; 7 miles west of Sonora Pass, Tuolumne Co., June 10, 1948.

AEDES HEXODONTUS Dyar

Although larvae of this species do not occur in the tremendous swarms in which *communis* are found, it is more catholic in its requirements both as to altitude and type of breeding place. It is often found in shaded pine-needle pools with *communis* but also in the open sun in meadow pools and hoofprints. I have collected it from 5,000 to 9,500 feet and it probably occurs at still higher elevations. Adult females are often confused with *com-*

munis but the torus in *hexodontus* is dark, the upright vertex scales are yellow, the scutum has a broad median brownish-yellow band and the supra-alar bristles are yellow.

In the larvae the complete sclerotized ring of the anal segment is unique among the California species of snow *Aedes*. Other characters are as follows: In 41 specimens (34 individually reared) from 10 different localities, 1 has 9 comb scales, 3 have 8 scales, 7 have 7 scales, 50 have 6 scales and 21 have 5 scales, giving an average of 5.94 scales. The upper head hairs vary from single to triple, the average being 1.9 branches. The lower head hairs are single or double, the average being 1.8 branches. The variation in siphon tuft branches is 4 to 9 with an average of 6.1 branches.

According to Matheson (1944), "*hexodontus* should probably fall as a synonym of *A. punctor*." Knight (1948) theorizes that *hexodontus* represents a western subspecies of *punctor* and that specimens which he studied from Umiat, Alaska represent an extreme of *hexodontus*. This problem evidently needs more study. Matheson's *punctor* has the head hairs (C and B) usually double, the comb of 8 to 17 scales in a double row and the siphon tuft with 3 or 4 branches. Knight's *punctor* (or *hexodontus*) from Alaska has the head hairs usually single, the comb of 5 to 13 (usually 7 to 8) scales, and the siphon tuft with 3 to 6 branches. As contrasted with these, California *hexodontus* have the head hairs usually double, the comb of 5 to 9 (usually 5 or 6) scales and the siphon tuft usually with 5 to 7 branches. Differences in female scutal pattern are also present, though somewhat variable. If it seems desirable to separate the Alaskan material, it will fall under either *cyclocerculus* Dyar or *punctodes* Dyar. In the meantime it appears best to place the Californian material under *hexodontus* as a distinct species.

Personal larval records are: Greenville, Plumas Co., May 8, 1948; Yuba Pass, Sierra Co., April 30, 1947; Calpine, Sierra Co., April 29, 1947; Hampshire Rocks Camp, Nevada Co., April 29, 1947; Little Truckee River, Eldorado Co., June 1, 1947; Meyers Meadows near Lake Tahoe, Eldorado Co., May 21, 1948; Camp Sacramento, Eldorado Co., June 10, 1947 and June 10, 1948; Grass Lake near Luther Pass, Eldorado Co., May 21, 1948; Carson Pass, Alpine Co., June 10, 1947; Winnemucca Lake, Alpine Co., 9500 feet, July 14, 1948; Silver Lake, Amador Co.,

June 10, 1947; Ebbett's Pass, Alpine Co., July 13, 1948; Sonora Pass, Tuolumne Co., 9500 feet, June 22, 1949.

AEDES CATAPHYLLA Dyar

The contrasting white and dark scales of the palpi in both sexes distinguish the adults of this species from those of *pullatus* which agree in having a long pale basal costal spot and a hypostigial spot of scales. Also, California *cataphylla* have the upright vertex scales of the female black or mixed black and pale, whereas in *pullatus* females these scales are golden.

The larvae of *cataphylla* are the only ones in California with pecten spines beyond the siphon tuft. The head hairs are commonly said to be single but this is not invariable. In 50 specimens collected in the Lake Tahoe region near the type locality, 6 of the upper head hairs are double, 1 is triple and 1 lower head hair is double. Thus, 93 percent of the upper head hairs are single and 99 per cent of the lower hairs are single. Similarly the statement is encountered in the literature that the pecten has 2 or 3 teeth beyond the pecten tuft (Matheson, 1944; Dyar, 1928), whereas the disposition of the pecten teeth is rather variable in my material. In 50 specimens, 11 have one or more detached teeth before the tuft and 5 have 4 or 5 detached teeth beyond the tuft. The total number of detached teeth varies from 2 to 5 with an average of 3.7. The comb is reported by Dyar (1928) to contain "about 15 scales." In my material the number varies from 10 to 21 with an average of 12.8 scales in 50 specimens.

The preferred larval breeding places seem to be in rather large ponds in the open meadows at altitudes from 6,000 to 9,500 feet. Adults bite in shade or at night. Personal larval records are: meadows south of Lake Tahoe, Eldorado Co., May 21, 1948; Meyers Meadows near Lake Tahoe, May 21, 1948; Hope Valley, Alpine Co., May 31, 1947 and May 21, 1948; Carson Pass, Alpine Co., June 10, 1947; Sonora Pass, Tuolumne Co., 9,700 feet, June 10, 1947.

AEDES PULLATUS (Coquillett)[1]

The only previous record of this species in California is that given by Howard, Dyar and Knab (1917), "Summit, Placer County, California, July 19, 1915 (H. G. Dyar)." Judging by

[1]Since this paper was submitted for publication, *Aedes pullatus* has been reported from Tuolumne Co., California, by P. T. Johnson and E. B. Thurman. See Pan-Pacific Ent. 26(3):107-110.

the date, the record was based on an adult female, and the identification was corrected to *A. communis tahoensis* in the appendix of the same volume. However, the species does occur in California as proven by my collection of larvae and reared adults of both sexes from Sonora Pass, Tuolumne and Mono Counties, about 9,500 feet, June 10, 1947. Larvae were taken from sunlit pools both in the large meadow west of the pass and a small meadow to the east. Associated larvae were *Aedes hexodontus, cataphylla* and *ventrovittis*. Attempts to find it in 1948 and 1949 were not successful. The adult female is the only one of the snow mosquitoes in California with the combination of a hypostigial patch of scales and all yellow upright scales on the vertex.

The larvae are similar to those of *communis* except for the more slender comb scales and the multiple head hairs. According to Dyar (1928) and Matheson (1944), the upper head hairs have 8 branches and the lower have about 4 branches. In my material from California, Colorado and Wyoming the upper head hairs rarely have as many as 8 branches. The California material, consisting of 15 specimens, have the upper head hairs with 5 to 8 branches, the average being 6.3, and only 1 of the 15 specimens has 1 hair on one side with 8 branches. The lower head hairs vary from 3 to 5 branches except 1 hair on one side with 8 branches, the average being 4.2 branches.

AEDES VENTROVITTIS Dyar

At certain times and places this small, dark mosquito occurs in great numbers. I have seen it so abundant at Young's Lake, Tuolumne Co., 10,300 feet, that the swarms dimmed the sunlight and hikers were forced to run through the infested areas. In spite of the abundance of the females at elevations from 6,000 to 11,000 feet in the central Sierra, the larvae are rarely seen. In fact the only published records are those of Dyar (1921, 1924) in which he recorded the larvae in snow-water pools in a meadow at 7,000 feet near Summit, Placer Co., and at Lake Tahoe at 6,000 feet in a roadside ditch fed with water from a snow bank. The 4 localities in which I have found larvae were all over 8,500 feet. These were a meadow above Winnemucca Lake, Alpine Co., 9,200 feet, July 14, 1948; a meadow near Blue Lakes, Alpine Co., 8,600 feet, July 13, 1948; and meadows on either side of Sonora

Pass, Tuolumne Co., 9,500 feet, June 10, 1947. In each case the larvae were associated with a lesser number of *hexodontus* in small, open, shallow pools, the water in which was warm to the touch. A single male was collected at the Blue Lakes locality flying near the breeding site. At the summit of Ebbetts Pass, Alpine Co., 8,700 feet, July 13, 1948, I collected larvae of *Culiseta incidens* (Thomson) in large pools and *Aedes hexodontus* in small meadow pools. A few *ventrovittis* females were biting and males of the same species circled above my head in singing swarms of several hundred individuals. As many as 50 were taken in one swoop of the net. According to Dyar (1928) and Matheson (1944) the larval head hairs are single, the comb has 7 (Dyar) or 6 to 9 (Matheson) scales, and the last 2 pecten teeth are more widely spaced. An examination of 50 specimens from Winnemucca Lake, Alpine County, gives the following figures: The head hairs are occasionally split toward the apex and 1 out of 100 upper head hairs is double. The comb scales vary in number from 6 to 18, are usually 8 to 12, and average 9.7. The detached pecten teeth vary from 1 to 4 with average of 1.9.

AEDES IMPIGER (Walker)

I have not collected this species, the larvae of which are supposed to occur with *cataphylla* according to Dyar (1928).

AEDES CINEREUS HEMITELEUS Dyar

The use of the subspecific name for Californian specimens of this species is probably justified by their generally darker body color. The small size and almost or entirely continuous line of white along the side of the abdomen are distinguishing features of the adult. Also, the male palpi are very short. The larvae have multiple head hairs, the comb in a partly double row, the siphon tuft situated at the apical one-third of the siphon and preceded by 2 or 3 detached teeth. In 22 specimens from the central Sierra the number of comb scales ranges from 9 to 14, with an average of 12.0. I have found larvae in meadow pools shaded by willows, the water often containing brown algae. The adults were observed to bite in the sun, but timidly and only near the ground. Personal larval records are: Little Truckee River, Eldorado Co., May 30, 1947; Meyers, Eldorado Co., May 28, 1949; Hope Valley, Alpine Co., May 31, 1947.

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A NEW DISTRIBUTION RECORD FOR PLEOCOMA BEHRENSII

(Coleoptera: Scarabaeidae)

BY PETER S. GRIMES

While on a field trip to Tomales Bay, Marin County, California, in October, 1948, the writer found a female specimen of *Pleocoma behrensii* LeConte[1] which has proved to be the most northernly confirmed record for the species. Previously it had been found only in the region immediately surrounding San Francisco Bay.[2]

The writer was examining the Pleistocene and Recent sediments in this area for fossils when the specimen was found about 15 feet below the top of the bank on the east shore of Tomales Bay, approximately 4 miles north of Point Reyes Station and nearly opposite the town of Inverness on the west shore of the Bay. The abdomen of the beetle was protruding from the bank out of a cavity which had apparently been exposed by wave action and recent rains. The bank was well rooted. The specimen was apparently dead when found.

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[1]Determination by E. G. Linsley.
[2]Linsley, E. G., 1938, Pan-Pacific Ent. 74 (2):56; (3):108.